

MEMORANDUM

TO: Curt Aldstadt, Farmers High Line Canal Company
Dan Strietelmeier, Farmers High Line Canal Company
Pat Dougherty, City of Arvada
Vic Elam, USFWS
Megan Estep, USFWS

FROM: Colby Hayden, Deere & Ault Consultants, Inc.
Jason Brothers, Deere & Ault Consultants, Inc.

RE: Two Ponds Canal Realignments – National Wildlife Refuge Stormwater
Routing; DAC Job No. 0130.003.00

DATE: June 16, 2005

Deere & Ault Consultants, Inc. (DAC) has performed preliminary hydrologic and hydraulic calculations in order to approximate the required drainage improvements to the Two Ponds National Wildlife Refuge property. For this study we evaluated the 100-year Urban Drainage and Flood Control District storm using CUHP/UDSWMM. Model input was developed from the topographical quadrangle map and available high altitude aerial photography, as well as site observation. This input data is suitable only for preliminary evaluation, and is not considered adequate for design purposes. In addition, the suggested dam improvements to both ponds are minimum impact recommendations, and have not been developed with consideration to any dam safety standards. Model input and output files that were used to form these recommendations are available upon request.

We have conservatively estimated that the upper pond will require a broad crested rectangular weir spillway having a width of 25 feet. The existing pond embankment/spillway configuration does not provide any spillway freeboard. Currently the pond's water surface extends up to the crest of the existing dam. This lack of freeboard would cause the embankment to overtop during larger runoff events. The pond embankment will need to be raised by roughly two feet to provide the necessary freeboard to contain the storm flows prior to discharging through the spillway. It may be possible to create the needed freeboard with minimal disturbance to the existing dam and surrounding vegetation by constructing a two foot high rock wall along the upstream side of the dam crest.

At the lower pond, we recommend replacing the existing 18-inch corrugated metal pipe (CMP), used to control the pond's high water line, with an 18-inch reinforced concrete pipe (RCP). This new pipe should include an appropriate entrance structure to ensure effective operation and avoid

debris fouling. The existing outlet pipe discharges to a city storm sewer inlet box. In addition, a broad crested outlet weir should be added to the pond embankment allowing larger flows to exit the pond. This trapezoidal weir should have a bottom width of 10 feet and 3:1 side slopes. The weir crest should be constructed to provide three feet of freeboard below the embankment crest. This spillway will discharge to the stormwater detention area east of Two Ponds National Wildlife Refuge.

The channel between the ponds will also require improvement. The design of this channel will require more detailed topographic information. However, given the relatively steep drop between the ponds, a trapezoidal channel with a 7-foot bottom width, 3-foot depth, 3:1 side slopes, and a channel slope of 3.5 percent would be adequate. One or more grade control structures will be necessary in this channel. A grouted boulder drop or similar type structure would be appropriate. The existing pedestrian bridge or a similar type bridge used to cross the channel between the ponds will need to be reset as part of this work.

We recommend these measures be taken in order to provide a compatible transition between the proposed stormwater crossing at Farmers' Highline Canal and the city drainage facilities downstream of Two Ponds National Wildlife Refuge. We have attached an aerial photograph showing the relevant drainage features.

If the project team wishes to pursue these drainage improvements, permitting requirements for work in the Refuge should be outlined and a detailed engineering analysis and design conducted to better define the work and potential impacts.

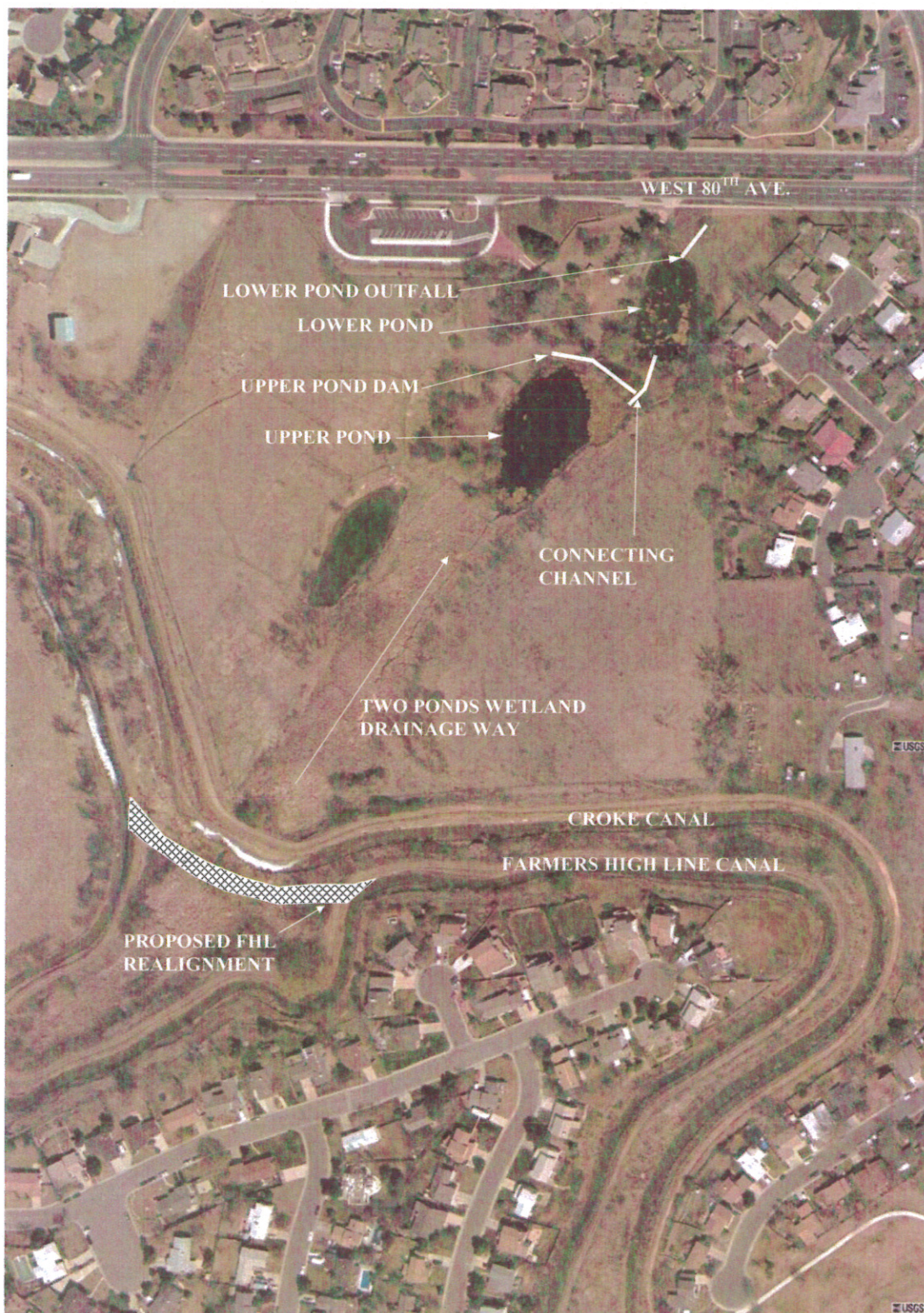


Image taken on 4/24/2002 courtesy of U.S. Geological Survey

N
(Not to Scale)

Farmers Highline Canal
Two Ponds Storm Drainage
DAC # 0130.003.00
June, 2005



LAST REVISION DATE 2

UPDATE IN PRC